DISSERTATION ON

ASYMPTOMATIC BACTERIURIA – EFFECT OF SCREENING AND TREATMENT ON MATERNAL AND FETAL OUTCOME

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BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"Asymptomatic bacteriuria – Effect of screening and treatment on maternal and fetal outcome"**, is a bonafide work done by **Dr.R.Manimegalai**, at the Institute of Obstetrics and Gynaecology and Government Hospital for Women and Children, Egmore attached to Madras Medical College, Chennai from 2006 – 2008 under our supervision and guidance in partial fulfillment of the regulations laid down by the Tamil Nadu Dr.M.G.R. Medical University – Chennai, for the award of the degree of M.D. in Obstetrics and Gynaecology.

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CONTENTS

INTRODUCTION

Urinary tract infections are the most common bacterial infections during pregnancy and are a common cause of serious maternal and perinatal morbidity. A urinary tract infection may manifest as asymptomatic bacteriuria, acute urethritis or acute cystitis or pyelonephritis. With appropriate screening and treatment this morbidity can be limited.

Asymptomatic bacteriuria refers to persistent actively multiplying bacteria within the urinary tract in women who have no symptoms. Worldwide the incidence varies from 5-10% and depends on age, parity, race and socioeconomic status.

Urinary tract infections are the most common bacterial infections during pregnancy. They occur in same frequency in pregnancy as in non-pregnant women. However the consequences of infection are far more serious during pregnancy warranting prompt diagnosis and treatment of infection.

With extensive study of asymptomatic bacteriuria since 1960 following points seem to emerge.

1. 25 – 40% of pregnant women with untreated symptomatic bacteriuria are likely to develop acute pyelonephritis.
2. Untreated convert bacteriuria has been associated with preterm delivery and low birth weight infant.
3. Increase in incidence of bacteriuria in low socioeconomic group women.
4. Screening and treatment of asymptomatic bacteriuria prevents most of the symptomatic urinary tract infections including pyelonephritis and decreases premature and low birth weight infants.
5. Women with recurrent infections and failure to respond to appropriate antibiotics show high incidence of abnormalities of the urinary tract.

Screening of all antenatal mothers for asymptomatic bacteriuria not only reduces the maternal and fetal morbidity but also identifies urinary tract abnormalities.

REVIEW OF LITERATURE

Among adults, routine screening for asymptomatic bacteriuria is only indicated during pregnancy during pregnancy and prior to urologic surgery.

Symptomatic infections of the urinary tract in pregnancy are well recognized since the late 1800.

Dodd showed in 1931 that bacteria were present in the urine of 11% of pregnant patients[44].

Awareness about screening and treatment of asymptomatic bacteriuria was largely unrecognized until mid 1950s. In 1955 quantitative approach to asymptomatic bacteriuria was followed.

Kass (1959) suggested that true bacteriuria could be separated from contamination by bacterial colony count of freshly obtained specimen of 105 colony forming units/ml of urine[48].

Pregnant women may frequently complain of symptoms such as lower abdominal pain, frequency, and dysuria. These symptoms are by themselves not diagnostic of UTIs. It is not routinely possible to separate

women with significant bacteriuria from women with sterile urine based on symptoms alone.

Prevalence

Generally UTIs are 14 times more common in women than men. About 15% of women will have a UTI at sometime during their life. Incidence of ABU varies from 2 – 7% during pregnancy (Williams 2000) depending on age, parity and socioeconomic status[3].

According to Mudaliar, the incidence is 5 – 10%. The incidence raises with age, parity, low socioeconomic status, women with sickle cell trait, diabetes mellitus and past history of UTI.

The highest incidence is seen in African American multiparas with sickle cell trait and lowest incidence is in affluent white women of low parity[3].

Age and parity

Kass 1960 reported increased incidence with age and parity. Little 1960 and Priscilla 1968 reported increased incidence withy primigravidas and decreased incidence with age.

Hooton and colleagues 2000 – the prevalence of bacteriuria in non-pregnant women is 5 – 6% and these are the same women in whom bacteriuria is discovered during prenatal care[2]. Calvin et al – in preschool children bacteriuria is 10 – 20 times more common in girls of 5-6yrs than boys.

Socioeconomic status

Turck, Goffe, Petersdorf noted 2% incidence of 2% in middle and 6.5% in lower socioeconomic group[30]. Kinlaid, Kaitz, Hodder indicated that socioeconomic factors influence the prevalence of bacteriuria[6].

Relationship to marriage and sexual activity

Kunin and McCormack (1968) reported lower prevalence in nuns compared to matched controls41. Aberdeen and Chalmers identified asymptomatic bacteriuria in 5 – 6% of married nulligravida and 6 – 8% in pregnant women.

The school years appear to be a reservoir of infection. Marriage and frequency of intercourse appear to be predisposing factor for UTI and increased further by condom use. These findings are explained by the mechanical effect of intercourse encouraging ascent of organisms up the

urethra, an effect that may be exacerbated by condom use particularly without lubricants[5].

The risk of UTI is also increased by a change in sexual partner, which may reflect male to female transmission of uropathogens. Use of spermicides as an adjunct to barrier contraceptive methods is also associated with an increased rate of periurethral colonization with E. Coli and other uropathogens, probably because nanoxynol – 9 is bactericidal against lactobacilli.

The protective effect of micturition soon after coitus is based on the supposition that washout of recently introduced bacteria will prevent establishment of infection[5].

Vaginal and periurethral flora

Maintenance of an acidic pH by lactobacilli present normally in vagina protects against colonization by uropathogens. Suppression of this normal vaginal flora by antibiotics or spermicide use increases the risk of vaginal and periurethral colonization with uropathogens and subsequent ascending UTI[5].

Genetic factors

In laboratory studies adherence of E. Coli to both vaginal and buccal cells is greater in women with recurrent UTI than in healthy controls. Women with recurrent UTI more frequently have gut colonization by uropathogens.

This difference in susceptibility to colonization and infection especially in patients in whom there is no other defect of host defense is due to genetically determine difference in extra cellular antigens to which bacteria adhere[5].

Predisposing factors for ABU and symptomatic UTI

Pregnancy, diabetes mellitus, single catheterization, indwelling catheter of more than 48hrs duration, cystocele, congenital and acquired obstructive urological disease, hydronephrolithiasis, sickle cell trait and use of broad spectrum antibiotics.

Normal changes in the kidney and urinary tract during pregnancy

Anatomical changes begin as early as 6 weeks of gestation and peak during 22 – 24 weeks and remain till term and revert to normal by second month after delivery.

The most obvious changes is dilatation of the calyces, renal pelvis and ureter due to the smooth muscle relaxant effect of progesterone in early pregnancy and compression of ureter by the gravid uterus at the level of pelvic brim in the late pregnancy. Typically the ureteral dilatation and stasis is greatest during second and third trimesters.

Hypertrophy of circular muscle bundles at the lower end of ureter has been proposed due to hyperestrogenism. All these changes are more marked on the right side and more likely to occur in first pregnancy and when pregnancies occur in rapid succession.

Bladder decreases in tone and its capacity increases due to progesterone so that in late gestation it can contain twice its normal contents without causing discomfort.

Physiological changes:

- Renal blood flow and glomerular filtration rate increase by 50 to 60%.
- Blood urea, serum creatinine and serum uric acid decrease as a result of increased urinary excretion.

- Urinary excretion of glucose increases due to decreased tubular reabsorption.

Factors contributing to UTI during pregnancy

Normally bacteria introduced into urine are rapidly cleared by three naturally occurring defense mechanisms:

- Neutrophils within the bladder wall phagocytose bacteria introduced into the urinary tract.
- Flushing effects of voiding.
- Inhibition of colonization by the high urea content and osmolality of urine.

Increased urinary stasis and vesicoureteric reflux due to decreased ureteral and bladder tone and increased bladder volume. 70 – 90% of pregnant women develop glycosuria, which encourages bacterial growth in urine. Urinary pH elevation during pregnancy encourages bacterial growth. Increase in the urinary progestins and estrogen may lead to decreased ability of lower urinary tract to resist invading bacteria. Animal experiments have shown that estrogen can enhance the growth of E. Coli strains that cause pyelonephritis. Renal medulla is particularly susceptible to infection because its hypertonic environment inhibits leucocyte migration, phagocytosis and complement activity.

Causative organisms

A few species of bacteria collectively known as uropathogens account for most UTIs. Normally urine is sterile. Organisms introduced by contamination are frequently the same as those causing UTIs.

E. Coli is the most common organism causing UTIs because of surface pili, which adhere to receptors on uro epithelial cells. It colonizes the distal urethra and vagina and perineal skin and contamination occurs during voiding and catheterization. (stuart et al 194) [8].

Data from Millar, Paul, Wing et al (2003) show the following causative organisms[9].

Escherichia Coli	86%
Proteus mirabilis	4%
Klebsiella pneumonia	4%
Enterobacter	3%
Staph. Saprophyticus	2%

Other less common organisms include streptococcus agalactiae, Staph. Aureus, Gardnarella, and Ureaplasma Urealyticum. GBS bacteriuria is an indication for intrapartum chemo prophylaxis.

The presence of a non uropathogenic species suggests an abnormality of host defense.

Pathogenicity

Pathogenicity of E. Coli appears to be due to a number of factors including surface pili, which adhere to uroepithelial cells, resistance to vaginal acidity, rapid division in urine, adherence to cells and the production of chemicals which decrease ureteric peristalsis and inhibit phagocytosis(Stein and Funfstuck 1999)[32].

The pathogenicity of Proteus species is due to motility - ability to ascend the urinary tract and that of Staph. Saprophyticus is due to its possession of a lactosamine adhesion molecule[5].

Diagnosis

ACOG 2002 recommends that screening for all pregnant women for asymptomatic bacteriuria be done by urine culture at the first prenatal visit[10].

The recommendation of US preventive Services Task Force is to obtain a urine culture between 12 – 16 weeks of gestation[12].

The gold standard for screening for ABU is urine culture[10].

Methods of collection of urine

Bacteria very easily contaminate urine samples during voiding from the perineal skin resulting in false positive results.

In women the reliability of urine culture can be improved by collecting midstream sample. The women are instructed to wash hands and clean perineum with water and part the labia with one hand and to ensure collection of a midstream sample without either the initial portion or the after drip.

Urine is an excellent culture medium for bacteria and hence sample is immediately plated or refrigerated at 4’ C and sent to laboratory within 4 hrs.

Pour plate method is the most precise and standard method for urine culture.

Criteria for significant bacteriuria

Criteria vary according to method of collection and symptoms[11].

In asymptomatic pregnant women two consecutive clean voided specimen more than 10^5 colony forming units of a single uropathogens per ml of urine.

In symptomatic pregnant women colony count more than 10^3 CFU per ml of urine is significant.

Any amount of growth in a sample obtained by supra pubic aspiration is significant.

Other screening tests for bacteriuria

1. Microscopic examination for bacteria and pus cells.
2. Tests for bacterial products
    a) Nitrite (Griess test) nitrite reduction test
    b) Catalase test
3. Screening test for pyuria – leucocyte esterase test.

Microscopic examination: Gram's stain of urine is an inexpensive method but it is not used as a screening test because methodically reviewing the smears is too labor intensive.. Gram's stain of centrifuged urine offers excellent sensitivity but poof specificity and is not an acceptable screening test for ABU[11].

The false negative rates of urine analysis (19.4%) and reagent strip testing (52.8%) preclude these from being screening tests for ABU in an obstetric population. It is concluded that urine culture should be used for all pregnant patients[11].

Griess Test (Nitrite reduction test): The rationale is that most uropathogens are nitrate reducing. False positive results may occur – if

the specimen is delayed in transit and overgrown with nitrate reducing bacteria. It is a rapid screening test taking 2 minutes to read by eye and pink color denotes positive test.

Limitations: False negative results occur if the organism is non nitrate reducing (e.g. Enterococcus) or if the patient is on vegetable free diet (loss of an important source of nitrate) or if insufficient time has elapsed since the last void for nitrites to appear at detectable levels.

Leucocyte esterase test: It is an enzyme produced by neutrophils. A reagent strip is used to detect its activity. The advantage is that the leucocytes need not be viable for LE activity to be detected.

False positive LE test may be due to high urinary levels of ascorbic acid or albumin level of more than 300mg/dl or from the effects of preservatives and detergents.

False negative LE test: when urine WBC counts are in the marginal range of 5-10/HPF,

when correlated with >10WBC/HPF

the sensitivity ranges from 70 to 84% and

specificity ranges from 70 to 94%.

U.S. Preventive Services Task Force (USPSTF 2000) [12] recommends that screening tests for ABU in pregnancy (dipstick and

direct microscopy) have poor positive and negative predictive values and urine culture is the gold standard for detecting ABU.

Urine culture is cost effective for routine screening in populations where the prevalence of asymptomatic bacteriuria is more than 2%.

Catalase test:

This test demonstrates the presence of catalase an enzyme that catalyzes the release of oxygen from hydrogen peroxide. One ml of H_2O_2 solution is poured over a 24hr nutrient agar slope culture of the test organism and the tube is held in a slanting position.

The production of gas bubbles from the surface of the solid culture material indicates a positive test. It almost occurs immediately. A false positive reaction may be obtained if the culture medium contains catalase. (e.g. blood agar) or if an iron wire loop is used. This test offers no advantage over other tests. It functions similarly to nitrite test and suffers from same defects.

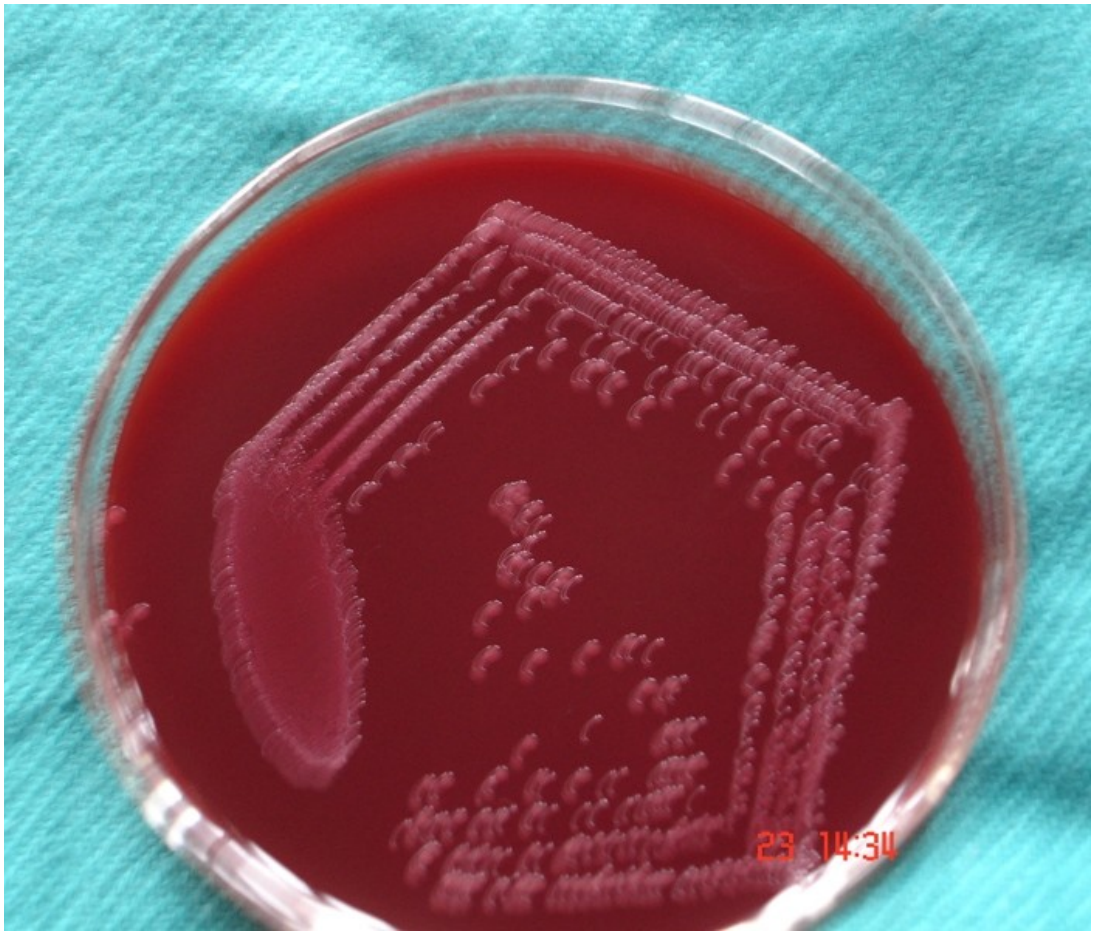
Table1

Results of rapid screening tests compared with urine culture.
(Millar et al Obstet. & Gynecol.Vol:95:601, 2000)

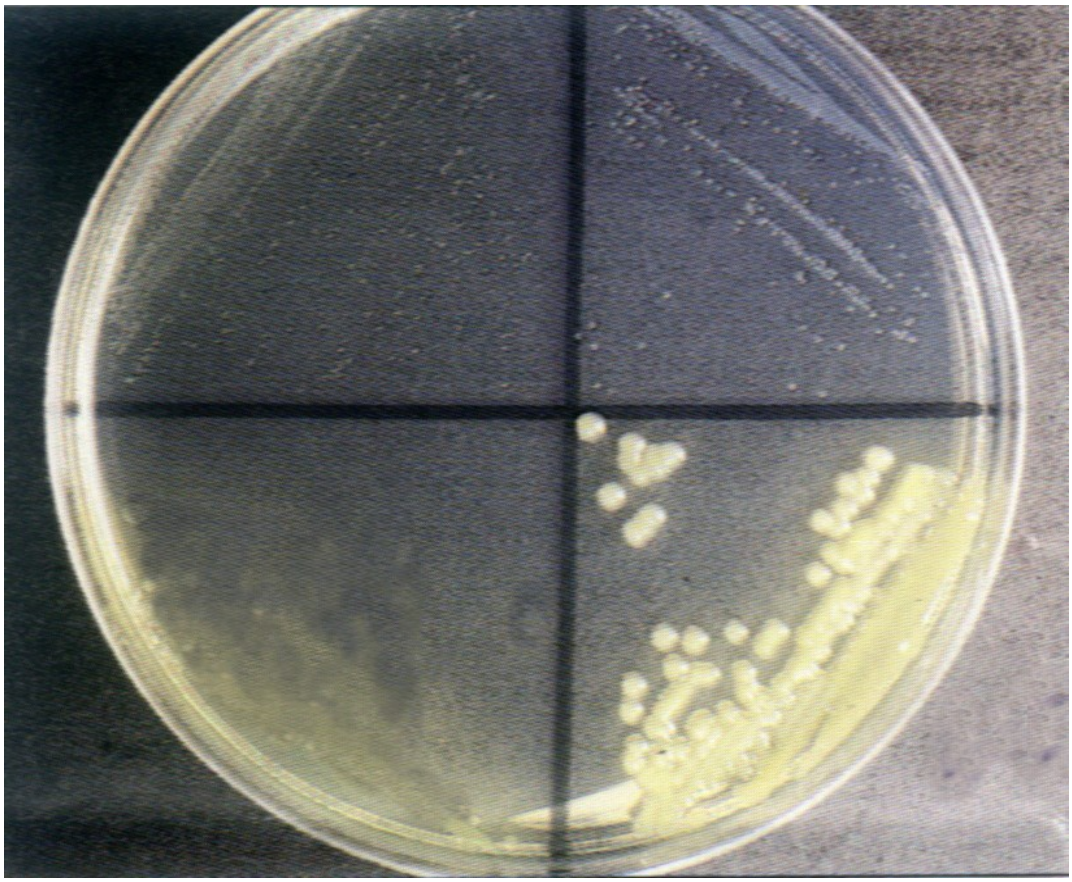
Screening test	sensitivity	Specificity	Positive predictive value	Negative predictive value
Catalase test	70(+/- 13.5)	45(+/- 5.5)	14(+/- 5)	92(+/- 4)
Nitrite test	45(+/- 15)	97(+/- 2)	63(+/- 17.5)	93(+/- 2.5)
Pyuria	67(+/- 16)	80(+/- 5.5)	30(+/- 9)	95(+/- 2.5)
LE test	69(+/- 14)	69(+/- 5)	22(+/- 6)	95(+/- 2.5)
Bacteria	93(+/- 8)	43(+/- 5.5)	18(+/- 4.5)	98(+/- 2.5)
Dipstick (LE + Nitrite test)	81(+/- 12)	97(+/- 2.2)	24(+/- 7)	97(+/- 2.2)
Microscopy (Pyuria + Bacteriuria)	93(+/- 8)	42(+/- 5.5)	17(+/- 4.5)	98(+/- 2.5)

The combination of leucocyte esterase and nitrite tests has better sensitivity and specificity in detecting asymptomatic bacteriuria than either test alone.

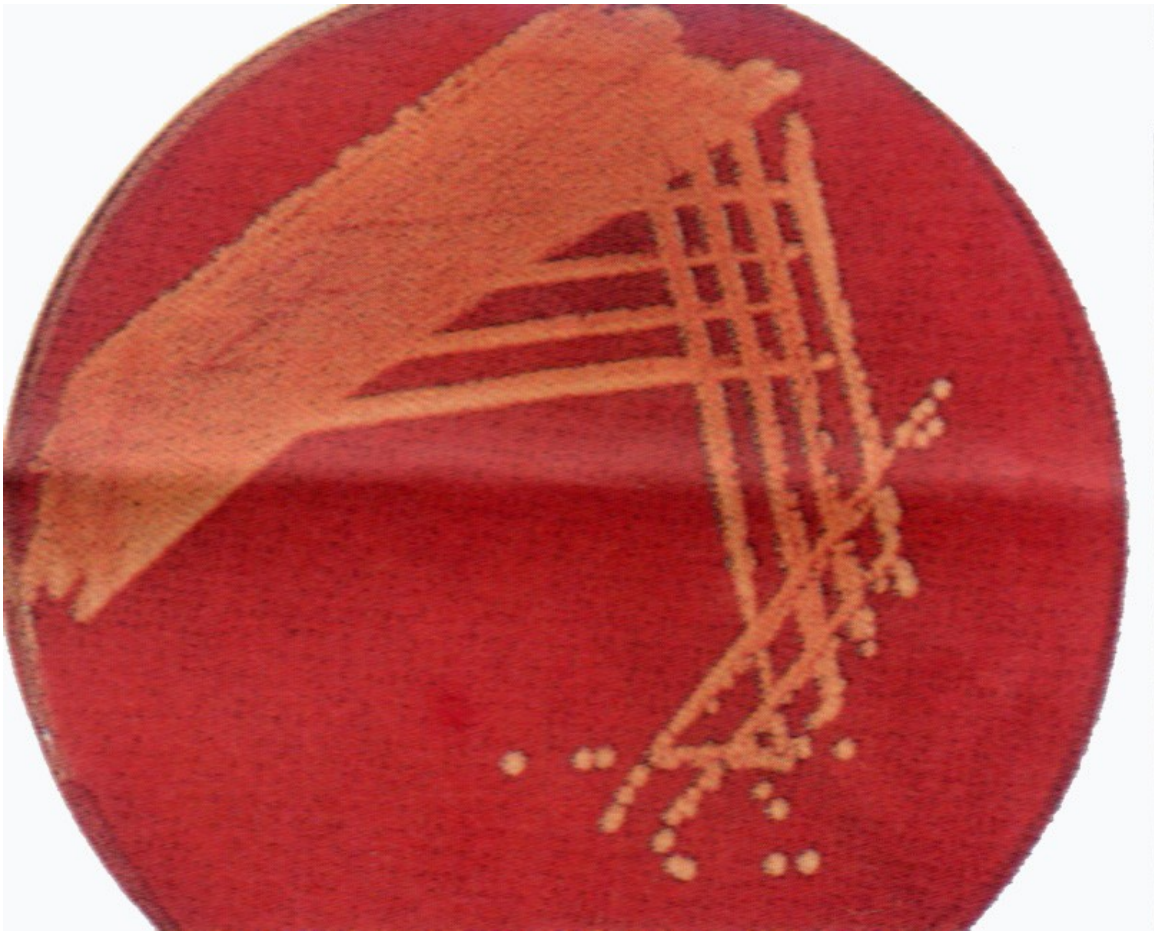
URINE CULTURE SHOWING GROWTH OF E.COLI



URINE CULTURE SHOWING GROWTH OF KLEBSIELLA.PNEUMONIAE



GROWTH OF STAPHYLOCOCCUS AUREUS ON BLOOD AGAR



Significance of asymptomatic bacteriuria in pregnancy

Acute pyelonephritis:

20 – 40% of untreated asymptomatic bacteriuric women develop acute pyelonephritis and these women are at increased risk for preterm delivery and low birth weight infants.[10,12,13,16.18,19.21,22,25,29,43].

Acute pyelonephritis occurs in 1 – 2% of all pregnancies and is the most common non-obstetric cause for hospitalization during pregnancy. It is the most common serious medical complication of pregnancy that can progress to maternal sepsis syndrome, preterm labor and delivery, renal dysfunction in 20%, adult respiratory distress syndrome in 1-2% due to endotoxin induced alveolar capillary membrane injury and endotoxin induced acute hemolysis(one third of these women develop acute anemia) and bacteremia in 20%.

Clinical manifestations of acute pyelonephritis usually occur 24 to 48hrs after the patient is admitted. Towers et al found pulmonary injury in 11 of 130 patients with pyelonephritis[49]. Some of these patients required endotracheal intubation, mechanical ventilation and PEEP. A fever of greater than 103'F, heart rate more than 110bpm and a gestation greater than 20weeks placed the patients at increased risk for pulmonary

injury. In his study the most predictive factors for ARDS were fluid overload and tocolytic therapy.

The diagnosis of acute pyelonephritis is made when bacteriuria is accompanied by abrupt onset of systemic symptoms or signs such as fever, rigor, nausea, vomiting, flank pain which is usually right sided and bilateral in 25%. Urine microscopy shows numerous bacteria and leucocytes.

The management of pregnant woman with acute pyelonephritis[3]:

1. Hospitalization
2. Urine and blood cultures
3. Hemogram, serum creatinine and electrolytes
4. Monitor vital signs frequently including urine output; consider indwelling catheter.
5. IV crystalloid to establish urine output to 30ml or more/hr
6. IV antimicrobial therapy
7. Chest X ray if there is dyspnea or tachypnea.
8. Repeat hematology and chemistry studies in 48hrs
9. Change to oral antimicrobials when afebrile

10. Discharge when afebrile 24hrs; Oral antimicrobials continued for 7-10days
11. Urine culture 1-2weeks after antimicrobial therapy completed.

IV antibiotics for acute pyelonephritis include

1. Inj. Ceftriaxone 1 to 2 g every 24hrs
2. Inj. Cefotaxime 1 to 2 g every 12hrs
3. Inj. Cefazoline 1 to 2 g every 8hrs
4. Inj. Aztreonam 1 g every 8hrs
5. Inj. Ampicilling 1 to 2 g every 6hrs with gentamicin 1mg/kg every 8 hours

Acute cystitis in pregnancy:

It is a distinct clinical entity. The diagnosis of acute cystitis is based on urinary urgency, frequency, dysuria and suprapubic pain and tenderness in the absence of systemic symptoms such as fever and costovertabral angle tenderness. Gross hematuria may be present; the urine culture is invariably positive for bacterial growth. It is important to recognize that only about 50% of women presenting with dysuria or other lower urinary tract symptoms will have bacteriologic confirmation of a urinary tract infection. Those cases with symptoms of urinary tract infection but without bacteriologic evidence of infection are called the

acute urethral syndrome, which is in many instances associated with chlamydial infection. Thus bacterial conformation is crucial to establishing a diagnosis of acute cystitis. Traditionally quantitative urine cultures were the gold standard and greater than 1lakh colonies per ml of urine, the significant count. Mucopurulent cervicitis often coexists and erythromycin therapy is effective.

Recently Stamm and coworkers suggested that in acutely dysuric patients a count of 100 colonies or more per ml is significant.

Women with cystitis respond readily to any of the several regimens. As with covert bacteriuria, a three-day course of therapy is usually 90% effective.

Bacteriuria and hypertension:

An increased incidence of hypertensive disorder of pregnancy has been alleged in pregnant women with ABU; such a relationship has been the subject of much controversy. Although some studies have confirmed this postulate[41,42,43], in general , most workers have failed to document any association between bacteriuria and hypertension[45,46,47]. Moreover the studies supporting an association between bacteriuria and gestational hypertension have reported conflicting results about whether or not eradication of bacteriuria by antimicrobial treatment reduces the

incidence of hypertensive disease of pregnancy among bacteriuric women[41,47]. In addition to demonstrating that there was no relationship between ABU in pregnant women and preeclampsia. Gilstrap et at found no difference in the pyelonephritis group versus their controls with no UTI[50].

Schieve et al (1994) found increased risk for hypertension or preeclampsia and maternal anemia.

Chazan et al 2003 reported a reduction in the incidence of hypertension in the treated group[39].

A Cochrane review 2000 reported no increased risk for hypertensive disorders in bacteriurics compared to general obstetric population[13]. When evidence of previous parenchymal damage is present, however there may be a greater propensity to hypertension (McGladdery et al)[34].

At present an association between asymptomatic bacteriuria and hypertensive disorders of pregnancy is questionable.

Bacteriuria and preterm delivery and low birth weight infants:

Pregnant women who develop acute pyelonephritis are at a significantly increased risk for preterm labour and delivery. In contrast

the relationship of ABU to preterm delivery, low birth weight, SGA babies and fetal mortality has been controversial.

In 1959 Kass reported that the prematurity is 24% in placebo treated group and 8% in bacteriuric patients treated with antibiotics[1]. He noted that prematurity rate was two to three times greater in bacteriuric women receiving a placebo than in non bacteriuric women or patients whose bacteriuria has been eliminated. Gruneberg and co workers noted that an increased rate of prematurity and decrease in their infants' birth weight occurred in those bacteriuric women who were either refractory to treatment or in whom bacteriuria had recurred[46].

Some investigations have reported that bacteriuric patients who do not respond to treatment are likely to have subclinical renal involment[42]. These data have been used to support the hypothesis that women with subclinical renal involvement are the population at risk to deliver preterm or low birth weight infants. Romero 1993 found strong correlation between asymptomatic bacteriuria and low birth weight and showed that treatment decreases its occurrence[19].

Christensen 2000 reported that treatment of bacteriuria decreases incidence of pyelonephritis and preterm labor to 1 –3% whereas the reported prevalence in untreated patients is 20-40%.

A Cochrane metaanalysis 2002 showed decreased incidence of pyelonephritis, preterm delivery and low birth weight infants with effective treatment of asymptomatic bacteriuria[13]. Many variables affect prematurity and bacteriuria is only one of the many factors that may influence the onset of premature labour. As the incidence of both pregnancy bacteriuria and prematurity increases with decreasing socioeconomic status, any relationship between bacteriuria and gestational length and birth weight may be complex and difficult to establish.

Evidence of transfer of infection from mother to fetus:

Certain bacteria including E. Coli are known to stimulate blood group antibodies. Recent studies have shown an increase in titre of isohaemagglutinins in the infants of mothers with E. coli bacteriuria. Lymphocytes of infants of mothers with E. coli infection show blast cell transformation when cultured in the presence of E. coli antigen extract. It appears that asymptomatic bacteriuria might result in dissemination of organisms to the maternal circulation to intervillous space to fetus.

Patrick demonstrated E. coli in amniotic fluid, placenta, umbilical cord of infants of mothers with bacteriuria.

Treatment of asymptomatic bacteriuria in pregnancy:

Since at a minimum bacteriuria predisposes the pregnant women to acute pyelonephritis, it is a potential hazard to the fetus. Thus the detection and treatment of ABU provides the obstetrician an ideal opportunity to prevent a significant medical complication of pregnancy. The aim of therapy is to eradicate bacteriuria and decrease the incidence of complication.

Selection criteria of antimicrobial drug:

- the drug should be safe for both mother and fetus
- the drug should be bactericidal
- the drug should address the common infective organisms (gram –ve enteric bacilli)

Majority of the antimicrobial drugs are excreted by glomerular filtration and as a result therapeutic concentrations are readily achieved in urine. In fact the concentrations of these drugs in the urine greatly exceed those required for the treatment of most UTIs. Even drugs that do not have a therapeutic concentration in the serum such as nitrofurantoin are present in significant concentrations in urine. The drug selected must have the narrowest spectrum of activity so that indigenous microflora of intestine and vagina avoided to prevent development of candiidasis.

Duration of treatment:

Conflicting evidence remains about shorter course or 7-10days course. A 7 – 10 day course is usually sufficient to eradicate the infecting organisms.

A Cochrane Systematic review 2000 included five regimens of antibiotic treatment and concluded that there were no significant differences between any of the regimens studied and was unable to recommend any particular regimen[13].

In general the results of single dose therapy appear to be inferior to those of longer course of therapy.

Antimicrobial agents used for treatment of pregnant women with asymptomatic bacteriuria(Williams et al 2000)[3].

Single dose therapy:

Amoxycillin 3g

Ampicillin 3 g

Cephalosporin 2 g

Nitrofurantoin 200mg

Fosfomycin 3 g

Three-day course:

Amoxycillin 500mg tds

Ampicillin 250mg qid

Cephalosporin 250mg qid

Nitrofurantoin 100mg bd

Trimethoprim / Sulphamethoxazole 160/800 mg bd

7 to 10-day course:

Amoxycillin 500mg tds

Ampicillin 250mg qid

Cephalexin 250mg qid

Nitrofurantoin 100mg HS

Treatment failures:

Nitrofurantoin 100mg qid X 21 days

Suppression for bacterial persistence or recurrence:

Nitrofurantoin 100mg HS or Cephalexin 250mg HS for remainder of pregnancy.

Recurrence rate reported for all the regimes is 30%. UTIs recur in 4 –5% of pregnancies. The risk of developing pyelonephritis is the same as the risk with primary UTIs[18].

Side effects of antibiotics during pregnancy

Sulphonamides	:	Avoided in the third trimester due to risk of kernicterus especially in preterm infants since it may bind to bilirubin binding sites on albumin.
Trimethoprim	:	Interferes with neural tube development.
Nitrofurantoin	:	When given in the last few weeks of pregnancy risk of hemolysis in case of G6PD deficient fetus.
Aminoglycosides	:	Nephrotoxic and ototoxic
Fluroquinolones	:	Interfere with cartilage formation

Pencillins, Cephalosporins, beta lactamase inhibitors, monobactums, fosfomycin are safe during pregnancy.

The effectiveness of therapy for ABU is best documented by Harris' report of decreased incidence of pyelonephritis in their institution after a screening programme had been implemented[52]. The incidence of pyelonephritis was reduced from 2.5% of all obstetric admissions in 1974 to 0.5% in December 1978. A similar dramatic decrease in the incidence of pyelonephritis in pregnancy following the introduction of a routine screening programme for ABU was noted at Parkland Memorial Hospital[53]. This occurred despite no decrease in the incidence of bacteriuria. Gratacos and coworkers recently reported a sharp reduction in the incidence of pyelonephritis (1.8 to 0.6%, $p < 0.001$) following the

introduction of a programme to screen and treat ABU in pregnant women[54].

Indications for postpartum urologic evaluation:

1. In patients with recurrent infections since they are more likely to have structural abnormalities of urinary tract.
2. In patients who have a recurrent urinary tract infection while on suppressive antibiotic therapy (Schwartz et al 1999).

Long term prognosis

20 – 65% of untreated patients clear their bacteriuria in the first postpartum year. Stuart et al 1984 found that there is no evidence to show that asymptomatic bacteriuria causes permanent renal damage or alter the lifespan of the patients[43].

AIMS OF THE STUDY

1. To find out the prevalence of asymptomatic bacteriuria in antenatal women at their first antenatal visit.
2. To know the association of bacteriuria with age, parity and socioeconomic status.

3. To know the common causative organism and treatment response to antibiotics
4. To find whether the incidence of symptomatic UTIs, preterm delivery and low birth weight infants decreases by treatment of asymptomatic bacteriuria
5. To find the correlation between asymptomatic bacteriuria and hypertensive disorders of pregnancy and maternal anemia.

MATERIALS AND METHODS

During the period from September 2006 to August 2007, 500 antenatal women between 12 to 16 weeks of gestation attending antenatal O.P. at Women and Children Hospital, Egmore were randomly selected. All the women were instructed to wash hands and clean perineum with water and to part the labia with one hand and to collect midstream urine sample without either the initial portion or the after drip. Thus clean voided midstream urine sample was collected and sent to laboratory within 2 hrs.

The urine sample of each patient was tested for the presence of nitrite by dipstick and one portion was sent for routine urine analysis and another portion sent for culture and sensitivity and colony count. Occurrence of pink color in the dipstick at the end of 2 minutes indicated positive nitrite test. Colony count of more than one lakh colony forming units of a single uropathogens per ml was taken as diagnostic of asymptomatic bacteriuria.

Treatment was given to all patients with significant bacteriuria with oral cephalexin 500mg bd X 7days. Urine culture was repeated one week after completion of treatment. Two patients had persistant bacteriuria

were treated with Inj. Gentamicin 80mg bd X 5days and then repeat cultures were negative.

Both bacteriurics and non bacteriurics were followed at monthly intervals. They were examined for clinical parameters like weight gain, blood pressure and complete hemogram, rountine urine analysis blood urea, sugar and serum creatinine. For all treated patients urine culture was repeated once in late second trimester and once in third trimester. For other patients, urine culture was repeated once in third trimester. All patients were followed up to delivery and discharge. The occurrence of acute symptomatic urinary tract infections (pyelonephritis and cystitis), preterm labor and delivery, hypertensive disorders and maternal anemia and low birth weight infants were noted. The perinatal outcome was studied.

Inclusion criteria

1. Pregnant women between 12 to 16 weeks of gestation irrespective of parity.
2. The pregnant women randomly selected had no symptoms or signs of UTI.
3. All women had normal BP.
4. Unskilled laborers on unfixed wages were considered to belong to socioeconomic class V. Skilled and semiskilled workers on fixed wages were considered class III and IV respectively.

5. In the absence of symptoms colony count of 10^5 or more colony forming units per ml of urine was taken as significant bacteriuria.

Exclusion criteria:

1. Pregnant women taking antibiotics for any reason were excluded.
2. Antenatal women with symptoms of UTI such as frequency, urgency, dysuria and supra pubic pain were excluded.
3. During the study women who were found to have hydramnios, multiple pregnancy, placenta praevia, congenital anomalies were excluded from the study.
4. Patients with anemia and hypertension at the first prenatal visit were excluded.

RESULTS AND OBSERVATIONS

Table 1. DISTRIBUTION OF ASYMTOMATIC BACTERIURIA

S No	Description	No of cases	Percentage
1	Urine culture positive (Bacteriurics)	54	11.73
2	Urine culture negative (Nonbacteriurics)	406	88.26

In this study the incidence of asymptomatic bacteriuria in antenatal women at their first prenatal visit was found to be 11.73%

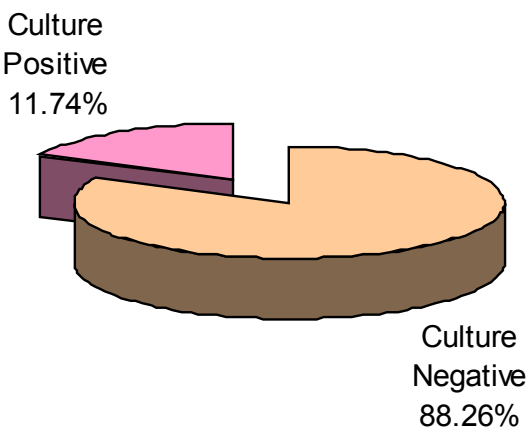
Table 2. DISTRIBUTION IN DIFFERENT AGE GROUPS

S No	Age group	Total no of cases	No of bacteriurics	Percentage
1	15 – 19yrs	98	7	7.14
2	20 – 29 yrs	271	43	15.86
3	30 – 39 yrs	91	4	4.39

X^2 test = 6.455 $p = < 0.05$

The incidence is more common in the age group of 20-29 years, which may be related to peak sexual activity in this age group, and it is statistically significant.

Incidence of asymptomatic bacteriuria in pregnancy



Incidence of bacteriuria in different age groups

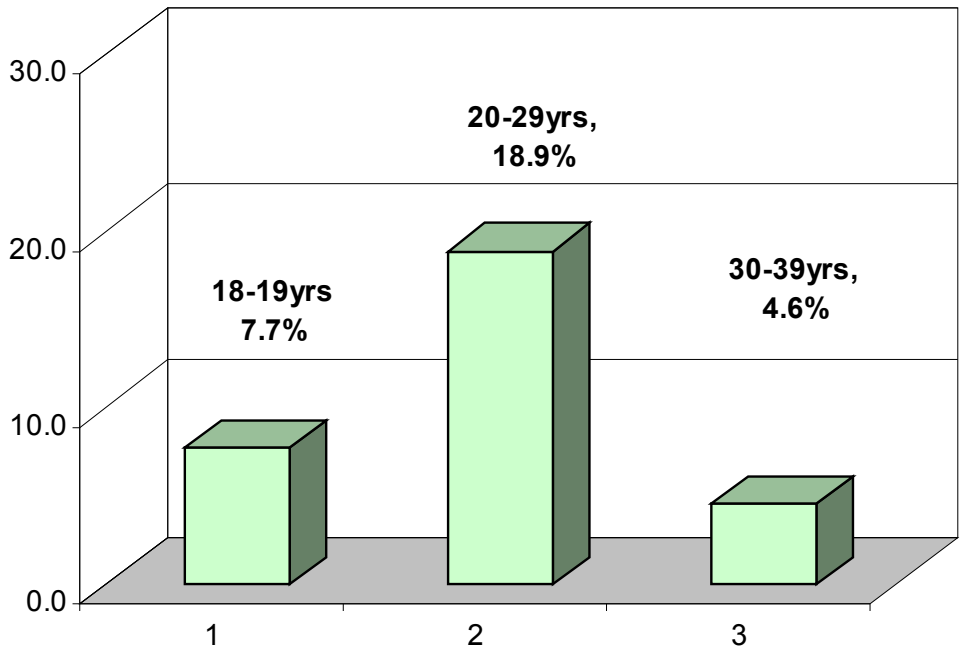


Table 3. DISTRIBUTION IN DIFFERENT GRAVIDA

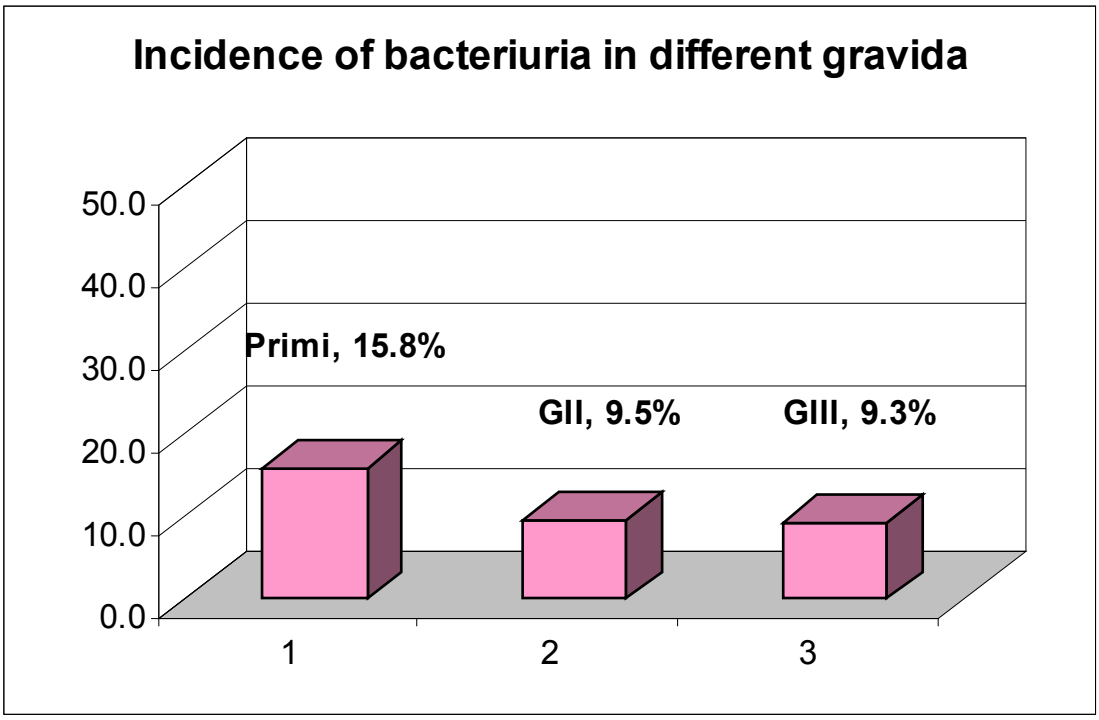
S No	Gravida	Total no of cases	No of bacteriurics	Percentage
1	Primi	286	39	13.63
2	G_2	115	10	8.69
3	G_3 & above	59	5	8.47

Maximum cases of bacteriuria occur in primigravida. This may be related to peak sexual activity and lack of knowledge about hygienic habits during sexual activity delayed post coital micturition.

Table 4. SOCIOECONOMIC STATUS

S No	Socio economic status	Total no of cases	No of bacteriurics	Percentage
1	Class V	346	44	12.71
2	Class III & IV	114	10	8.77

There is a high incidence of ABU in the lower socioeconomic group due to lack of knowledge, low literacy and poor personal hygiene and lack of facilities to maintain hygiene.


Incidence of bacteriuria in different gravida
50.0
40.0
30.0
20.0
10.0
0.0
Primi, 15.8%
GII, 9.5%
GIII, 9.3%
1
2
3

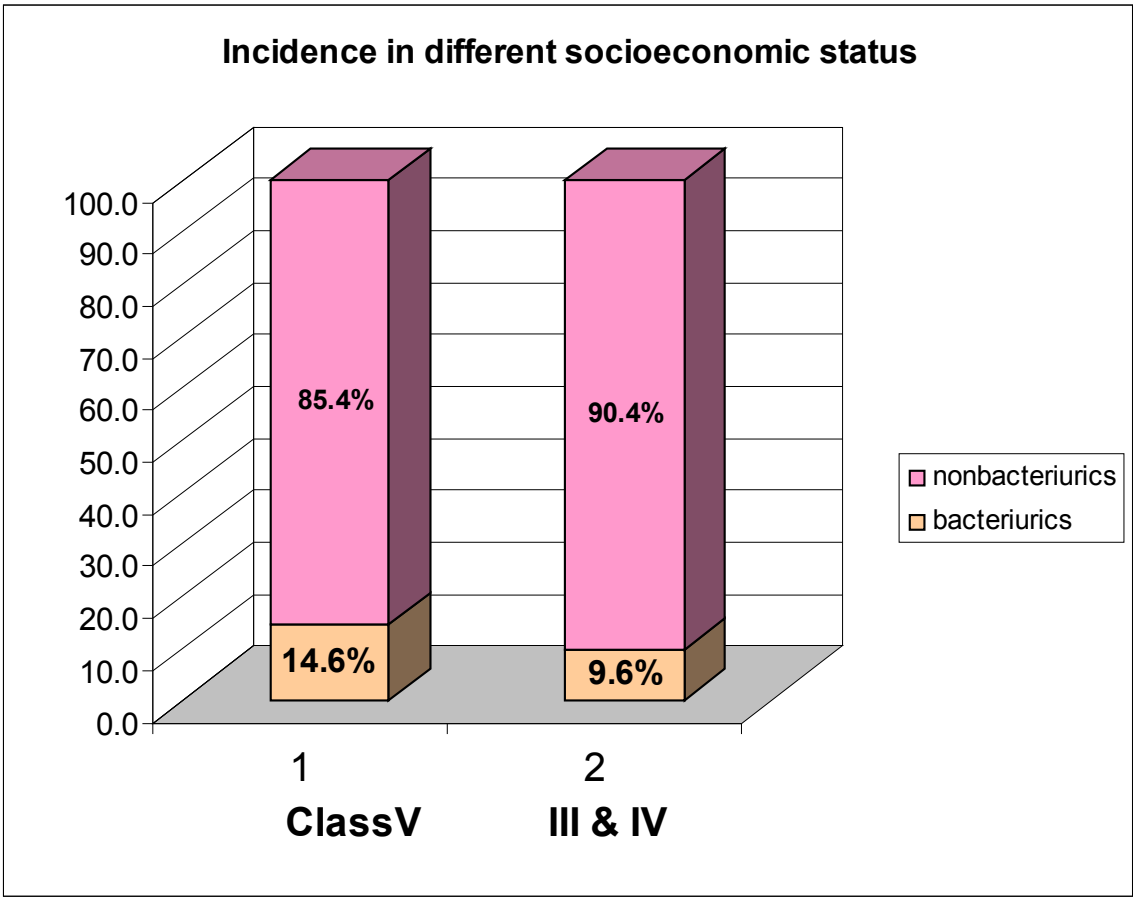

Incidence in different socioeconomic status
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
85.4%
14.6%
90.4%
9.6%
nonbacteriurics
bacteriurics
1
ClassV
2
III & IV

Table 5. PAST HISTORY OF URINARY TRACT INFECTION

S No	Gravida	Total no of cases	No of bacteriurics	Percentage
1	Primi	40	8	20
2	G_2	24	6	25
3	G_3 & above	18	5	27

$X^2 = 0.172$ **$p > 0.05$**

Previous urinary tract infection is a significant risk factor for asymptomatic bacteriuria during current pregnancy regardless of parity. Previous UTI may cause subtle renal damage that may be unmasked during pregnancy.

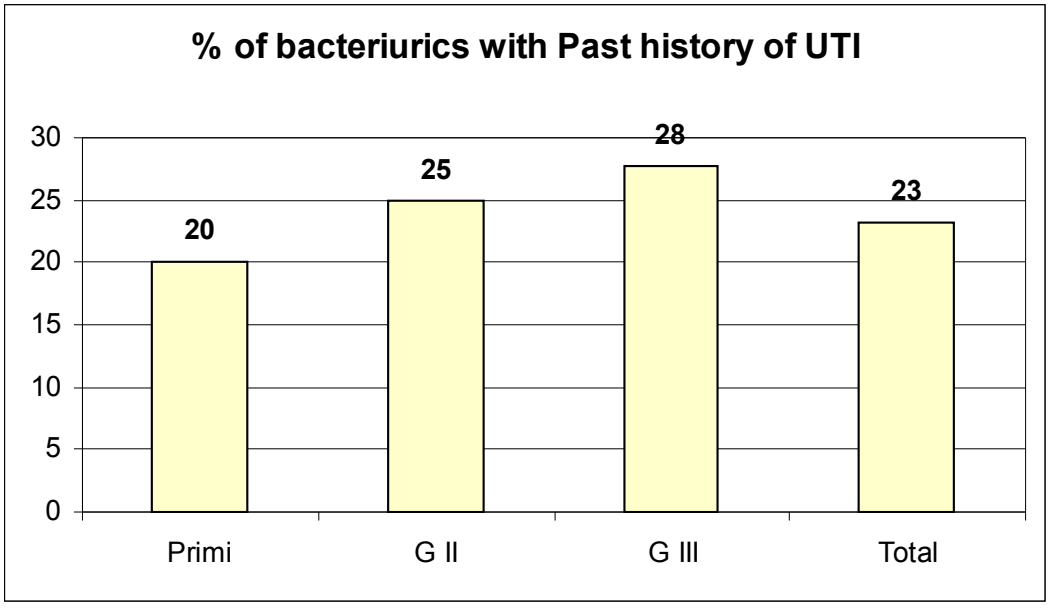


Table 6. RECURRENT SYMPTOMATIC UTI

S No	Prenatal visit	No of bacteriurics	Percentage
1	First visit	54	0
2	Late 2nd trimester	2	3.7
3	3rd trimester	4	7.4

Out of treated bacteriuric patients 2 women in late second trimester and 4 in third trimester developed symptoms of acute cystitis and culture was positive for E. coli and all 6 women were treated with oral cephalexin 500mg bd X7days. None of the patients in both groups developed pyelonephritis.

Table 7. URINE NITRITE DIPSTICK TEST

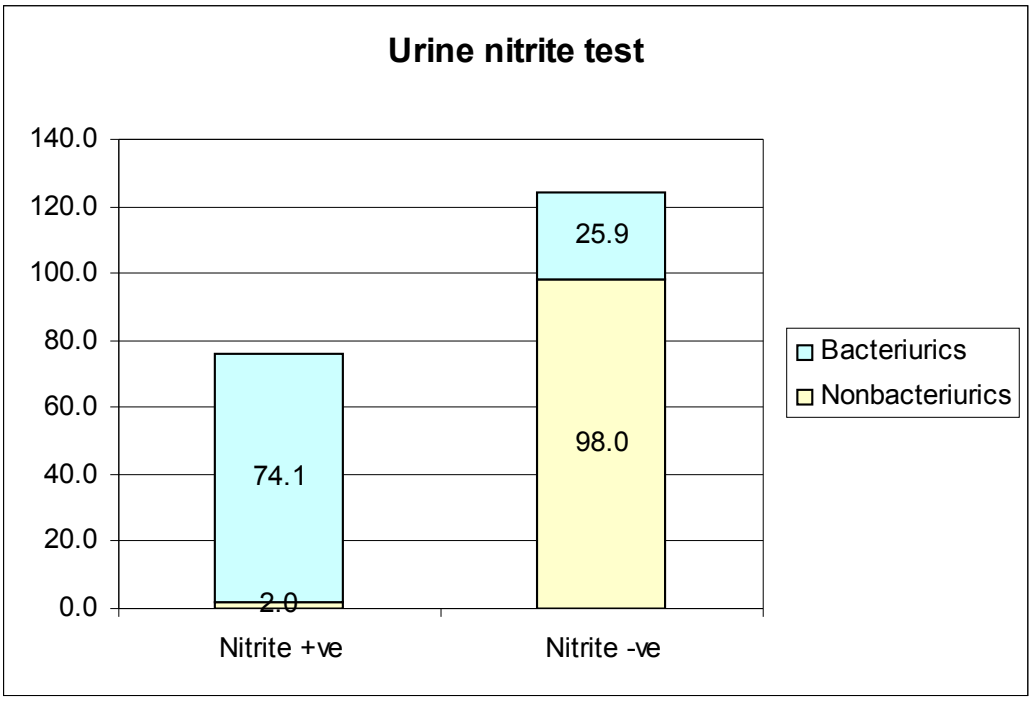
S No	Description	Nitrite positive	%	Nitrite negative	%
1	Bacteriurics	40	74.07	14	25.92
2	Non bacteriurics	8	2	398	98

The sensitivity of this test is 74% and false negative rate is more than 25%. When this test alone was used for screening about one fourth of the bacteriurics would have been missed.

Table 8. URINE ANALYSIS

S No	Description	Total No of of cases among bacteriurics	Nonbacteriurics
1	Proteinuria	24 (44%)	36 (9%)
2	Pyuria	34 (63%)	16 (4%)

Proteinuria is increased during pregnancy and levels upto 300mg/dl are considered normal. It is increased during UTI because of release of protein from leucocytes. Leucocyte excretion is increased in bacteriurics.


Urine nitrite test
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
74.1
2.0
25.9
98.0
Nitrite +ve
Nitrite -ve
Bacteriurics
Nonbacteriurics

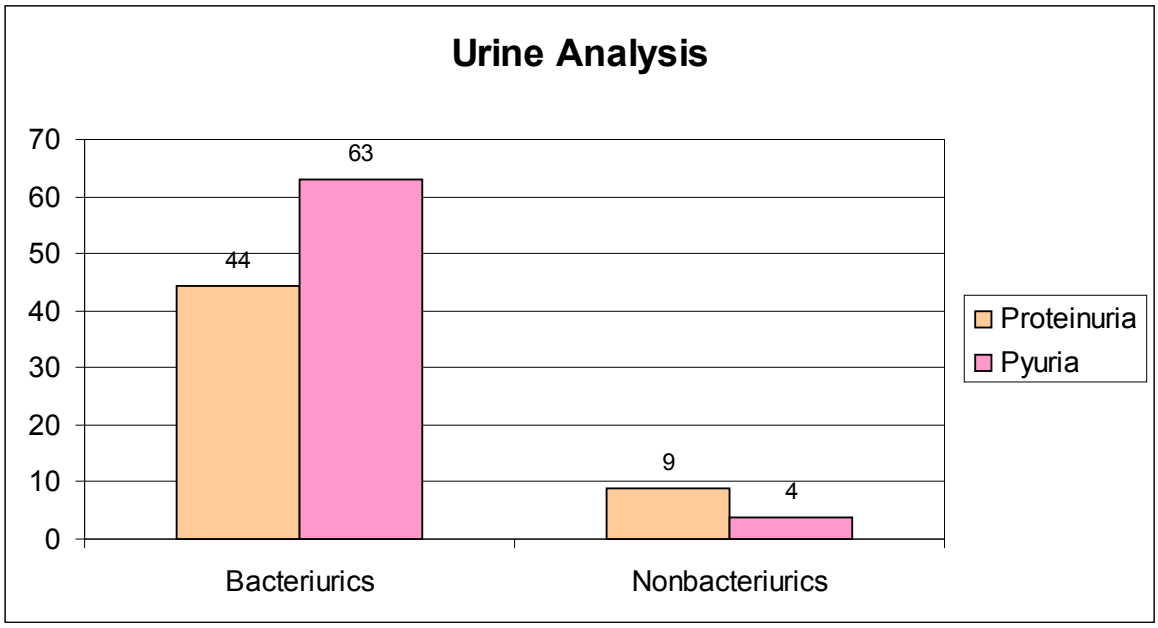

Urine Analysis
70
60
50
40
30
20
10
0
44
63
9
4
Bacteriurics
Nonbacteriurics
Proteinuria
Pyuria

Table 9. CAUSATIVE ORGANISMS

S No	Organisms	No of of cases	Percentage
1	E. coli	49	90.7
2	Klebsiella	4	7.4
3	Staph. aureus	1	1.85

The most common causative organism is Escherichia coli accounting for 90% of cases. The organisms are usually gram negative enteric bacilli. These are collectively called as uropathogens.

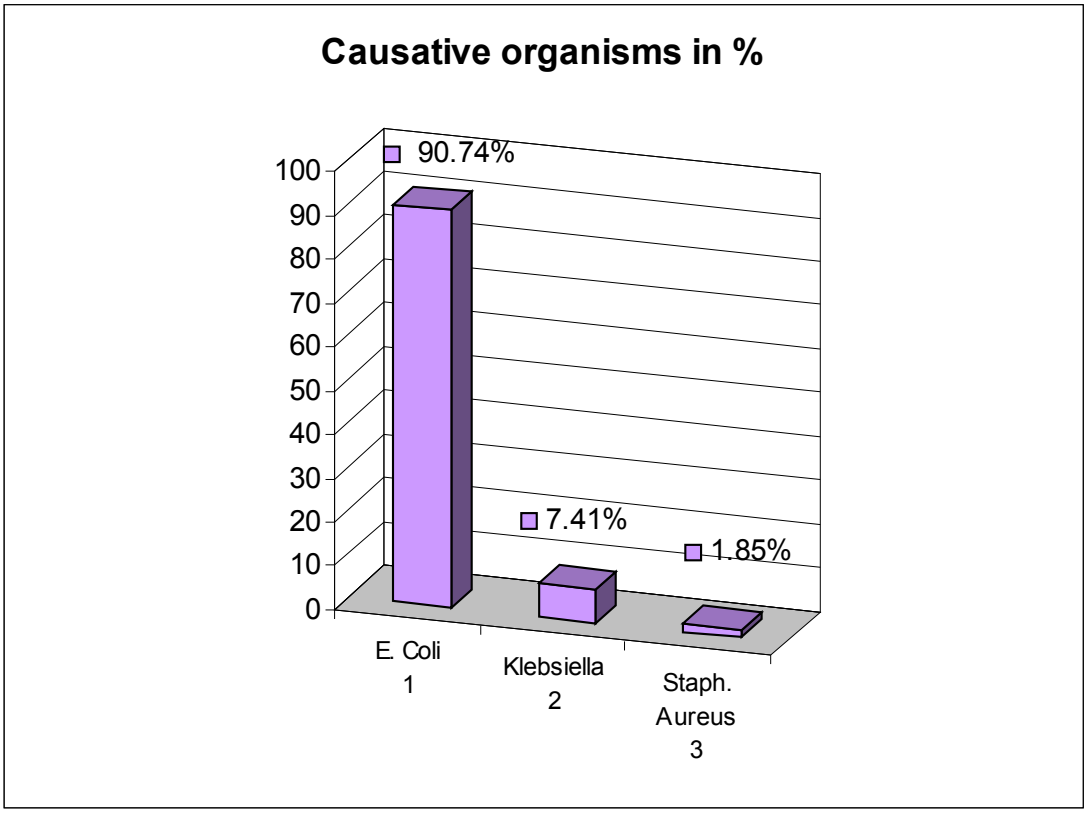


Table 10. ANTIBIOGRAM

Organism	No of isolates	Cipro	Norflox	Cef	Ami	Gara	Ampi
E. coli	49	49 (100%)	49 (100%)	47 (97%)	49 (100%)	48 (98%)	35 (71%)
Klebsiella	4	4 (100%)	3 (75%)	4 (100%)	4 (100%)	3 (75%)	2 (50%)
Staph. Aureus	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	-	-

Historically ampicillin has been the drug of choice but in recent years E. coli has acquired resistance to ampicillin. In this study there is 71% sensitivity of E. coli to ampicillin. Alternatively the cephalosporins are well tolerated and adequately eradicate the common organisms.

Table. 11 DISTRIBUTION OF ANEMIA

S No	Hb in gm%	Non bacteriurics		Bacteriurics	
1	> 10	274	67.48%	35	64.81%
2	< 10	132	32.51%	19	35.18%

$X^2 = 0.154$ **$p > 0.05$**

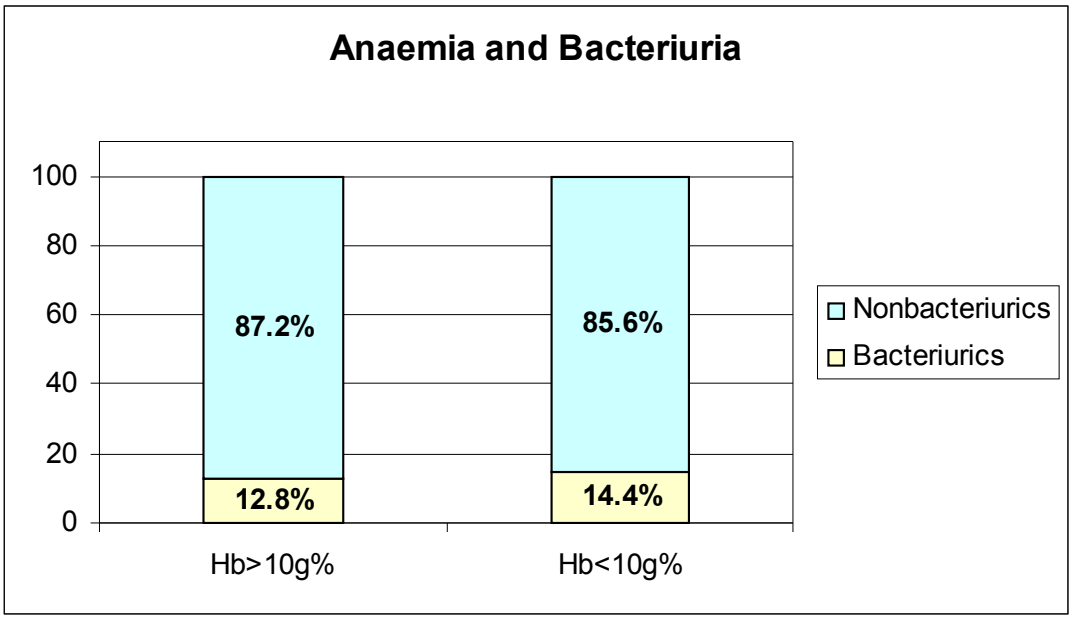
The incidence of anemia in bacteriuric group is 35% and in nonbacteriurics it is 32%. The difference is not statistically significant.

Table 12. DISTRIBUTION OF PREECLAMPSIA

S No	Description	Total no of cases	No of cases preeclampsia	Percentage
1	Bacteriurics	54	5	9.25
2	Non bacteriurics	406	35	8.62

$X^2 = 0.024$ **$p > 0.05$**

The occurrence of preeclampsia among bacteriurics is comparable to that of non bacteriurics and the difference is not statistically significant.


Anaemia and Bacteriuria
100
80
60
40
20
0
87.2%
12.8%
85.6%
14.4%
Hb>10g%
Hb<10g%
Nonbacteriurics
Bacteriurics

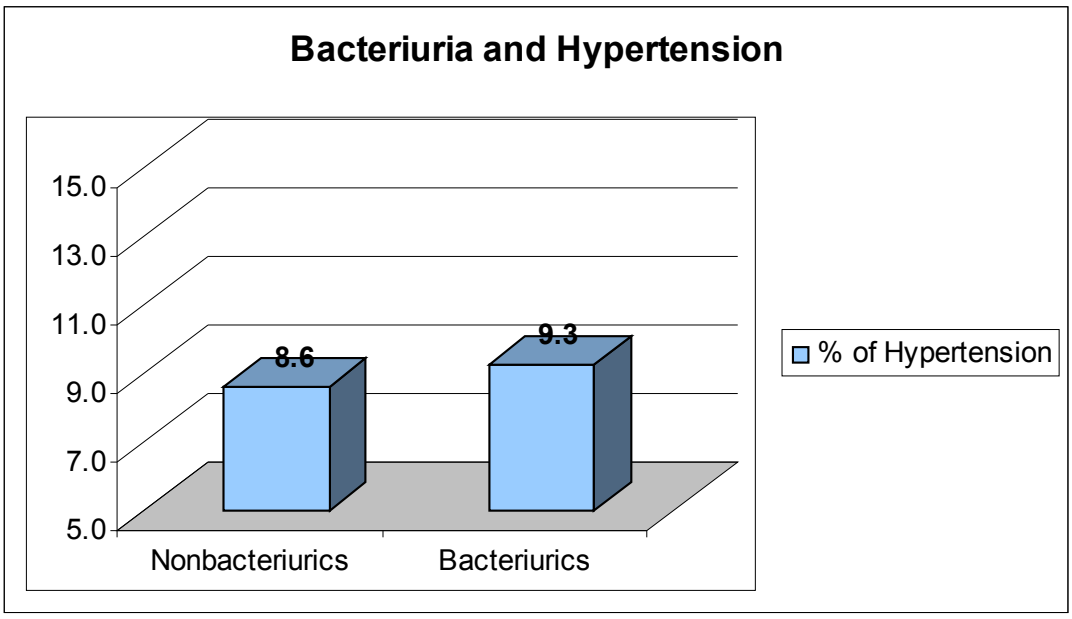

Bacteriuria and Hypertension
15.0
13.0
11.0
9.0
7.0
5.0
8.6
9.3
Nonbacteriurics
Bacteriurics
% of Hypertension

Table. 13 MODE OF DELIVERY

S No	Description	Non bacteriurics		Bacteriurics	
1	Labour natural	278	68%	38	74%
2	Forceps	18	4%	2	4%
3	LSCS	110	27%	12	22 %

$X^2 = 0.248$ **$p > 0.95$**

The difference in the number of operative deliveries in bacteriurics treated with antibiotics and nonbacteriurics is not statistically significant. IUGR was present in woman with bacteriuria and the postnatal outcome was good.

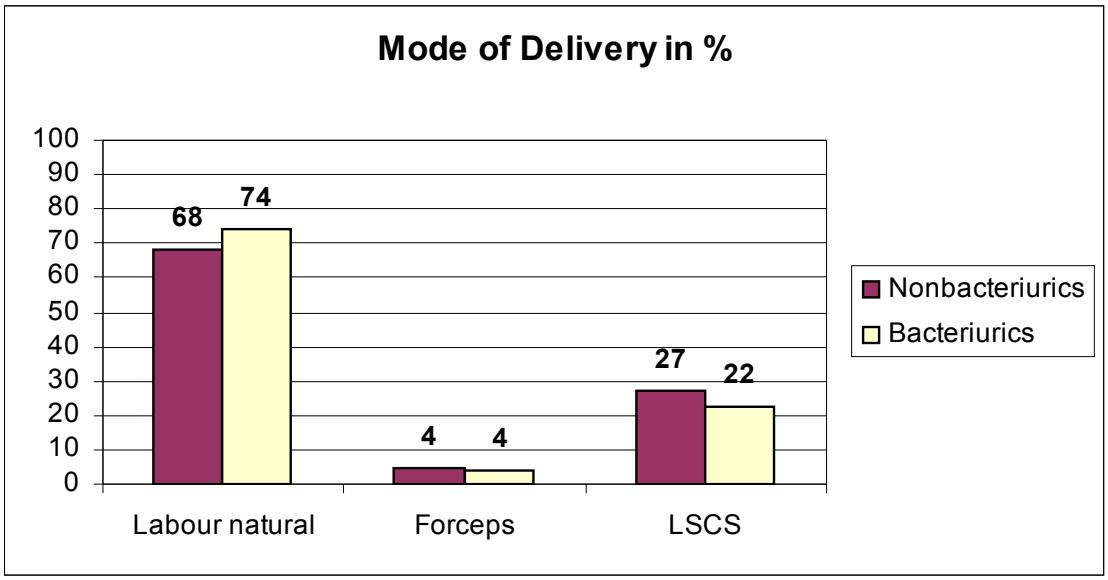


Table 14. FETAL OUTCOME

S No	Gestational age at delivery	Bacteriurics	Nonbacteriurics
1	37 completed weeks and above	48 (88.7%)	378 (89.4%)
2	34 weeks to 36.6 weeks	6 (9.2%)	25 (8.6%)
3	28 weeks to 33.6 weeks	0	3 (0.7%)

$X^2 = 0.14$ **$p > 0.05$**

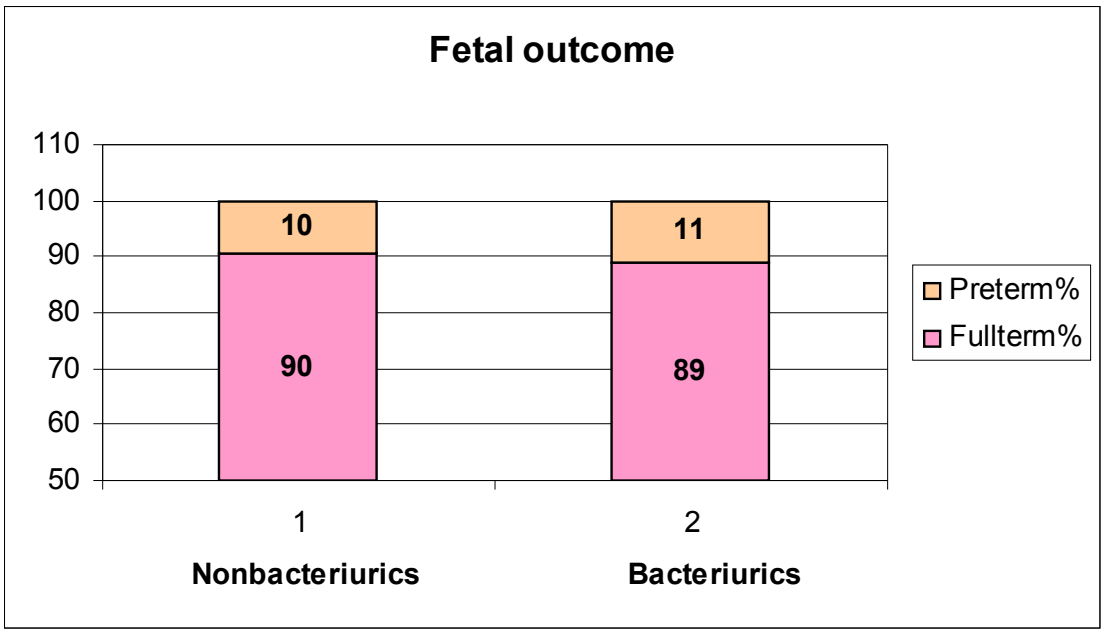
There were no cases of preterm delivery in the bacteriuric pregnant women treated with antibiotics between 28 to 34 weeks and all five cases of preterm deliveries were between 34 to 37 weeks of gestation whereas there were 3 cases of preterm deliveries between 28 to 34 weeks and 25 cases after 34 weeks in non bacteriuric women. The difference is statistically not significant.

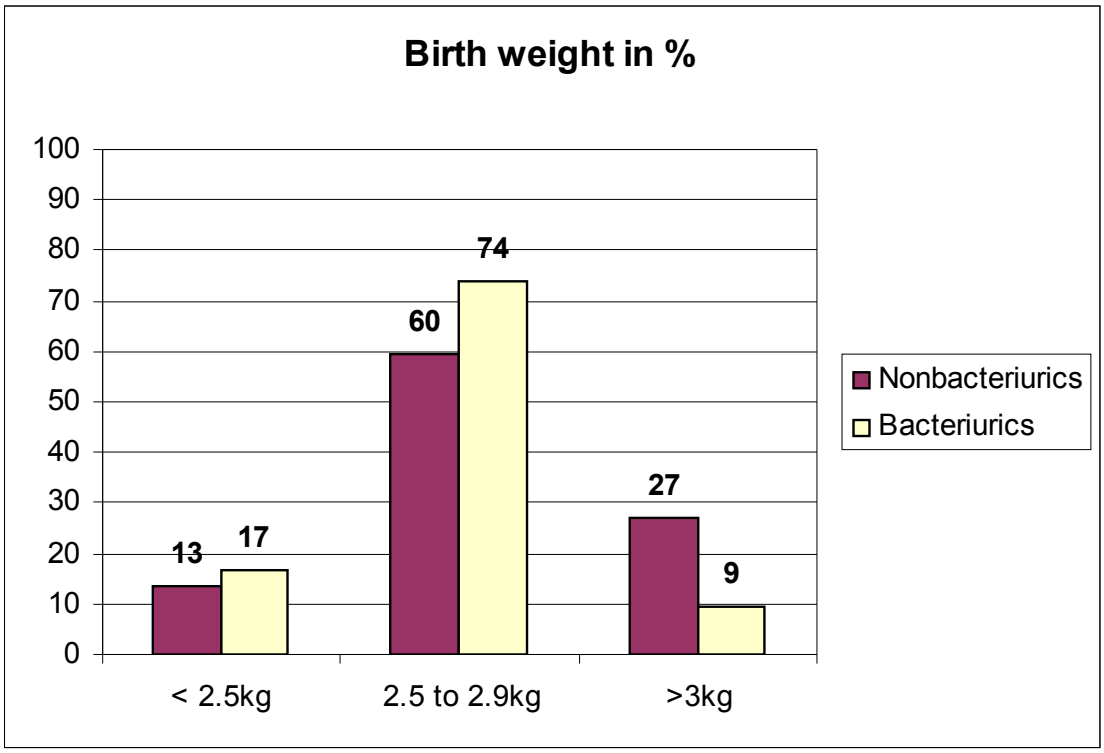
Table 15. DISTRIBUTION OF LOW BIRTH WEIGHT

S No	Birth weight	Bacteriurics	Nonbacteriurics
1	1 to 1.5kg	0 (0%)	4 (1%)
2	1.6 to 2.4kg	9 (16.6%)	50 (12.3%)
3	2.5 to 2.9kg	40 (74.1%)	242 (59.6%)
4	3 kg & above	5 (9.2%)	110 (27.1%)

$X^2 = 2.022$ **$p > 0.3$**

The occurrence of low birth weight infants appears to be higher in bacteriuric women treated with antibiotics and all infants weighed between 1.6 to 2.4kg. The difference in low birth weight infants in both groups is not statistically significant. There were three neonatal deaths in nonbacteriuric group all less than 1.5kg and all the deaths were due to respiratory distress syndrome.


Fetal outcome
110
100
90
80
70
60
50
10
90
11
89
1
2
Nonbacteriurics
Bacteriurics
Preterm%
Fullterm%


Birth weight in %
100
90
80
70
60
50
40
30
20
10
0
13
17
60
74
27
9
< 2.5kg
2.5 to 2.9kg
>3kg
Nonbacteriurics
Bacteriurics

DISCUSSION

Out of the 500 pregnant women screened at 12-16 weeks of gestation 460 women were taken for statistical analysis. The distribution of asymptomatic bacteriuria among these women is 11.73%.

Incidence

According to Mudaliar, the incidence of ABU varies between 5 – 10%. The incidence of bacteriuria during pregnancy varies from 2- 7% depending on age, parity, race and socioeconomic status (Williams 2002)[3]. In this study the incidence is 11.7% which may be related to low socioeconomic status.

Age and parity

Initially Kass showed that frequency of ABU during pregnancy increases with age and parity. Little and priseilla reported decreasing incidence with age and increased incidence in primigravidas. Hooton and colleagues reported that prevalence of bacteriuria in non pregnant women is 5-6% and these are the same women in whom bacteriuria is discovered during prenatal care[2].

The physiological changes of ureteral and renal pelvis dilatation are more pronounced during first pregnancy and less marked changes

lead to reduced incidence in multigravida (Manndess, Douglass and Bennets 2004)[7].

This study correlates with these findings in that the incidence is more in primigravidas (13.6%) and in the age group of 20 – 29 years (15%) attributed to peak sexual activity, which favors periurethral colonization with enteric bacilli.

Socioeconomic status

Women from lower socioeconomic groups have a higher prevalence of UTI in pregnancy (Brenner – The Kidney 2004) [22].ABU during pregnancy is more common in women in low socioeconomic status (Williams 2003) [3]. A Cochrane Database Systematic review has shown that asymptomatic bacteriuria may be marker for low socioeconomic status, which is associated with low birth weight.

This study correlates with these findings in that the incidence in low socioeconomic groups is 12.7% reflects the importance of literacy, health awareness and personal hygiene in the prevention of UTIs.

Past History of urinary tract infection:

Women with a history of bacteriuria during childhood have an increased frequency of UTI during pregnancy compared with pregnant women with no previous history of bacteriuria (Paller and Connaire). The possibility that asymptomatic bacteriuria during childhood results in

subtle renal damage that can be unmasked during pregnancy is suggested by the finding that GFR increased less in such women during pregnancy[22].

In this study past history of UTI and treatment with antibiotics was present in 40 primigravidas and 20% of these women had bacteriuria during pregnancy and 25% of second gravidas and 27% of third gravidas with past UTI had ABU during pregnancy. P value is more than 0.05 and the difference is statistically not significant.

Recurrent infection:

The UTIs in pregnancy recur in 4 – 5% of pregnancies even with appropriate treatment. The risk of developing pyelonephritis is the same as the risk with primary UTIs (John E. Delzell and Michael L. Lefevre 2000)[18]. ACOG 2002 and American Academy of Pediatrics recommend that a urine culture be obtained at the first visit and a repeat urine culture in the third trimester because the urine of treated patients may not remain sterile for the entire pregnancy[10].

30 – 40% of the pregnant women with untreated asymptomatic bacteriuria later have pyelonephritis compared to 3% in those treated with antibiotics (Christensen 2000; Sweet 1977).

A Cochrane Database Systematic Review (2000) has shown that drug treatment of asymptomatic bacteriuria in pregnant women substantially reduces the risk of pyelonephritis[13].

Correlating with these studies with the present study, there were no cases of pyelonephritis in both groups and there were 2 cases of acute cystitis in second trimester and 4 cases in third trimester. The urine cultures were positive for E. coli and all patients responded to oral cephalexin 500mg bd X 7days.

Urine nitrite test

Bachman and associates (2000) compared dipstick leucocyte esterase and nitrite tests with urine culture and found only one half of patients with bacteriuria were identified with dipstick tests.

Rouse and colleagues (2002) [14] performed a cost benefit analysis of screening for bacteriuria in pregnant women versus in patient treatment of pyelonephritis and found a substantial decrease in overall cost with screening for ABU.

In a prospective study for evaluation of reagent strips in detecting ABU in early pregnancy in Liverpoo Women Hospital 1998, it was concluded that urine dipstick tests are not sensitive enough to be used for screening and that many patients would be missed[20]. A Cochrane

Database Systematic Review 2000 recommends formal bacteriological culture as the gold standard for screening for ABU.

In this study nitrite test was positive in only 40 patients with bacteriuria. Sensitivity was 74%. If this test alone was used for screening more than one fourth of cases would have been missed.

Proteinuria is increased in UTI as a result of release of proteins from leucocytes but is neither sensitive nor specific[5,22]. Pyuria defined as more than 5-7 pus cells per high power field in pregnant women more often indicates urinary tract infection rather than colonisation[22].

In this study pyuria was present in 62% of bacteriurics and 16% of nonbacteriurics.

Causative organisms

Data from Rubin, Beam, and Wing et al show that the most common isolate is E. coli and other organisms included proteus, Klebsiella, Staph. Aureus and saprophyticus and enterococcus.

In this study E. coli is the most common organism accounting for 90% of cases and Klebsiella was isolated from 4 patients and Staph. Aureus in one patient.

Antibiotic sensitivity

A Cochrane systematic review 2000 studied 5 regimens and was unable to recommend any particular regimen[13].

Resistance to ampicillin was found in 20 – 30% of cases of E. coli infection [18]. Masterton 1998 demonstrated a cure rate of 88% with a single dose of ampicillin. Several other studies have shown single dose of any drug to be less successful with cure rate of 50 – 78%. Hence a 3 or 7-day course is recommended by most.

In this study the sensitivity of E. coli to ampicillin is 71%. All gram negative bacilli and Staph aureus were sensitive to cephalosporins and quinolones. All patients were treated with oral cephalexin 500mg bdX 7days since quinolones are contraindicated in pregnancy. 2 patients had repeat cultures positive for E. coli and were treated with Inj. Gentamicin 80mg bd X 5days. Both these drugs were well tolerated.

ABU and anemia and preeclampsia

Schieve et al 1994 studied 27746 pregnant women and found that UTI during pregnancy was associated with premature labor, hypertensive disorders of pregnancy, anemia and amnionits[15]. But this study did not prove cause and effect relationship. Several others have attempted to relate asymptomatic bacteriuria to development of hypertensive disorders, but the results have been unclear.

In this study anemia was present in 32.5% in non bacteriurics and 35.18% of bacterirurics. p value is more than 0.05 and the difference is not statistically significant. Five patients among bacteriurics developed preeclampsia (9.25%) whereas 8.62% of nonbacteriurics developed preeclampsia. p value is more than 0.05. The difference is not statistically significant.

ABU and premature delivery and low birth weight infants

Treatment of ABU during pregnancy at the first prenatal visit in early gestation decreases the incidence of premature delivery and low birth weight and its associated perinatal mortality[1, 3, 5, 7, 10,13].

In this study the incidence of preterm delivery in non bacteriurics was 8.65% and in bacteriurics treated with antibiotics was 9.25%. p value is more than 0.05 and the difference is not statistically significant.

The incidence of low birth weight is 16.6% in bacterirurics treated with antibiotics and 13.3% in non-bacteriurics. The p value is more than 0.3 and the difference is not statistically significant. There were three neonatal deaths in non bacteriuric group with birth weight between 1 to 1.5kg. There was no neonatal mortality in the bacteriuric group.

This study correlates with above studies in that the antibiotic treatment of asymptomatic bacteriuria during pregnancy substantially reduces the incidence of preterm delivery and low birth weight infants comparable to that of non bactetriurics.

SUMMARY

500 antenatal women attending antenatal O.P. at Women and Children Hospital, Egmore, Chennai were screened for ABU at the first prenatal visit between 12-16 weeks of gestation during the period from September 2006 to August 2007 with quantitative urine culture. Five patients who were found to have hydramnios, multiple pregnancy, placenta praevia and congenital anomaly of fetus were excluded from the study. 35 women were lost during followup. 460 women were taken into account for statistical analysis. Both bacteriurics and non bacteriurics were followed upto delivery and the adverse effects of bacteriuria in mother and neonate were observed and analyzed. The results are summarized as follows:

The incidence of ABU in the study group was 11.73% attributed to low socioeconomic status of the women.

Screening at the first antenatal visit 54 pregnant women were found to be culture positive for bacteria and most were in the age group of 20 – 29 years (15.8%) and most were primigravida (13.6%) which may be related to early marriage and peak sexual activity which favors periurethral colonization of bacteria.

Among the bacteriurics 70% were primigravidas. This shows that these women might have had bacteriuria even before marriage, which has been unmasked by pregnancy changes in the urinary tract.

Among the bacteriurics 80% belonged to socioeconomic class V an important association found in literature.

A significant proportion of patients had past history of urinary tract infection and treatment with antibiotics.

Nitrite test was positive in only 94% of bacteriurics suggesting that it is not sensitive enough to be used as sole screening test.

Pyuria was present in 62% of bacteriurics, which cleared after antimicrobial treatment suggesting infection than mere colonization. Acute cystitis developed in 6 women among bacteriurics and 4 women in non-bacteriuric group. No cases of pyelonephritis occurred in both groups suggesting that early screening and treatment of ABU is essential in preventing this complication.

E. coli was the most common causative organism as in various studies world wide. Resistance to ampicillin was present in 30%.

The incidence of anemia and preeclampsia in both groups was comparable and this study did not show a cause and effect relationship.

The occurrence of low birth weight infants and preterm delivery was reduced similar to that in non-bacteriurics suggesting the importance of screening and treatment of ABU during pregnancy.

CONCLUSION

From this study it is concluded that in view of potentially serious sequelae of asymptomatic bacteriuria, routine screening of all pregnant women at their first prenatal visit is recommended and that antibiotic treatment and follow up of cases helps in the reduction in the incidence of symptomatic urinary tract infections, preterm delivery and low birth weight infants.

PROFORMA

Name: Age: Occupation:

OP No: Unit: Income:

Address: Religion: Education:

Date of admission: Date of delivery: Date of discharge:

Compliant:

Menstrual H/o

Obstetric H/o Gravida Para LMP EDD

Contraception LVB Last abortion

Past History: Urinary tract infection, hypertension, preeclampsia, diabetes mellitus.

Family history : Hypertension, diabetes mellitus, renal disease, CNS, RS.

Obstetric examination:

Laboratory Investigation:

Urine : protein sugar microscopy

Urine culture sensitivity colony count

Hb PCV

Blood urea Blood sugar Serum creatinine

Pregnancy outcome Abortion preterm preeclampsia

Mode of delivery preterm labour natural forceps LSCS

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Abbreviation

ABU	: Asymptomatic bacteriuria
ARDS	: Adult respiratory distress syndrome
CFU	: Colony forming unit
E. Coli	: Escherichia coli
GBS	: Group B streptococcus
GFR	: Glomerular filtration rate
Hb	: Haemoglobin
HPF	: High power field
LE	: Leucocyte esterase
PEEP	: Positive end expiratory pressure
PET	: Preeclampsia
SE Status	: Socioeconomic status
SGA	: Small for gestational age
UTI	: Urinary tract infection
WBC	: White blood cell